

**(19) World Intellectual Property
Organization
International Bureau**



(43) International Publication Date
3 November 2005 (03.11.2005)

PCT

(10) International Publication Number
WO 2005/102883 A1

(51) International Patent Classification⁷: B65G 53/28

(21) International Application Number:
PCT/GB2005/001606

(22) International Filing Date: 27 April 2005 (27.04.2005)

(25) Filing Language: English

(26) **Publication Language:** English

(30) Priority Data:
0409318.3 27 April 2004 (27.04.2004) GB

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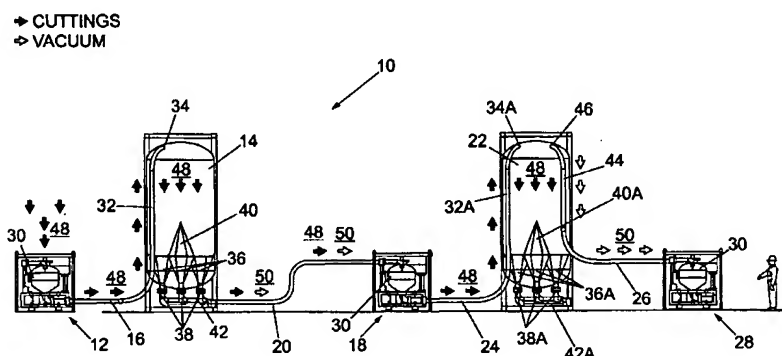
(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GR, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published: — with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A METHOD AND AN APPARATUS FOR CONVEYING PARTICULATE MATERIAL



(57) **Abstract:** A method of, and apparatus for, transferring material, which may be hydrocarbon exploration and production industry by-products in the form of drill cuttings (48), from a first location to a second location is described. A first container (14) is provided containing fluid and the material is transferred from a first location outside of the container (14) to a second location inside the container (14). Fluid, which is typically air, is at least partially evacuating from within the container (14) in order to facilitate progression of the material into the container (14).

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A METHOD AND AN APPARATUS FOR CONVEYING PARTICULATE MATERIAL

1
2
3 The present invention relates to apparatus and a
4 method for transporting material, and particularly
5 but not exclusively relates to apparatus and a
6 method for transporting non free flowing or
7 relatively sticky paste-like materials such as those
8 produced by hydrocarbon exploration and production
9 operations.

10
11 In the hydrocarbon exploration and production
12 industry it is often necessary to transfer large
13 quantities of material from, for example, a drill
14 rig to a transport vessel in order that the material
15 can then be transported to an on-shore location for
16 further processing/disposal. The materials used
17 in/created by drilling operations such as drill
18 cuttings, pastes or sludge are often highly viscous
19 substances which are therefore difficult to
20 transport due to their cohesive properties. One way
21 of transporting such materials is to empty them into
22 a container or skip and then transport the container

1 or skip onto a vessel; however manoeuvring the
2 container or skip around the rig, as required in
3 such a method, presents a number of dangers to
4 personnel operating on the rig.

5
6 In order to transfer drill cuttings from the rig to
7 the vessel more safely it is known to transfer the
8 drill cuttings firstly to a number of large holding
9 tanks. When the holding tanks are full, they are
10 connected via tubing to transport tanks on board a
11 transport vessel and transferred thereto using
12 compressed air or a similar propellant in order to
13 assist progression of the material along the tubing;
14 however such systems can become blocked due to the
15 difficulty in obtaining a large enough pressure
16 differential along the long distance of tubing
17 between the rig and the vessel. The tendency for
18 highly viscous materials to stick together rather
19 than to flow, combined with the fact that the long
20 tubing has a tendency to sag thereby creating
21 certain areas along the pipe where the flow of the
22 highly viscous materials must act against gravity,
23 makes blockages along the pipe more likely.

24
25 According to the present invention there is provided
26 a method of transferring material from a first
27 location to a second location comprising the steps
28 of:-

29 providing a container containing fluid;
30 transferring material from a first location
31 outside of the container to a second location inside
32 the container; and

1 at least partially evacuating fluid from within
2 the container in order to facilitate progression of
3 the material into the container.

4

5 Preferably, the transfer of material from the first
6 location to the second location and evacuating the
7 fluid from the container are performed substantially
8 simultaneously.

9

10 Preferably, the method further comprises the step of
11 transferring the material along a first conduit
12 under application of pressure upstream of the
13 material, in order to progress the material from a
14 first location outside of the container to a second
15 location inside the container.

16

17 Preferably, the method further comprises the step of
18 at least partially evacuating the fluid, which is
19 preferably gaseous and is more preferably air, from
20 the container along a second conduit in order to
21 substantially create a vacuum within the container.

22

23 Preferably, the fluid is at least partially
24 evacuated from the container whilst substantially
25 avoiding removal of the material from the container.

26

27 Preferably, the method further comprises the step of
28 providing a second container, which is typically
29 upstream of the first container, where the second
30 upstream container typically provides a temporary
31 storage facility for material to be transported.

32

1 Typically, the method further comprises the step of
2 providing a first pumping means for pumping material
3 which may be from a source of material into the
4 second container under pressure such that the
5 material may be deposited in the second container
6 prior to being transferred to the first container.
7 More preferably, pressure is applied to the second
8 container and the material therein when the second
9 container contains a desired level of material.
10 More preferably, the second container is then
11 emptied by evacuating at least a portion of the
12 material within the second container, typically
13 along a discharge conduit, which action is
14 preferably assisted by the pressure applied to the
15 second container.
16
17 Preferably, the discharge conduit is in fluid
18 communication with the first conduit via an
19 intermediate or transfer pumping and/or vacuum
20 generation means in order to allow the material from
21 the second container to be conveyed to the first
22 container.
23
24 Typically, the first container is located on a
25 transportation means such as a sea going vessel and
26 the second container is located proximal to the
27 first pumping means and also is preferably located
28 proximal to a supply of the material such as a
29 primary drill cuttings source such as on a drilling
30 rig. Preferably, the intermediate or transfer
31 pumping and/or vacuum generation means is located
32 proximal to and downstream of the second container.

1 Typically, a transfer conduit connects the
2 intermediate or transfer pumping and/or vacuum
3 generation means to the first container.

4
5 Preferably, the material comprises drill cuttings.

6
7 According to the present invention there is provided
8 material transfer apparatus comprising:-

9 a container containing fluid;
10 material transfer means adapted to transfer
11 material from a first location outside the container
12 to a second location inside the container; and
13 material urging means adapted to facilitate
14 transfer of the material from the first location to
15 the second location by at least partially evacuating
16 fluid from within the container.

17
18 Preferably, the material transfer means comprises a
19 first tubular conduit which passes through an inlet
20 portion of the container and more preferably further
21 comprises an intermediate or transfer pumping and/or
22 vacuum generation means connected thereto.

23
24 Preferably, the intermediate or transfer pumping
25 and/or vacuum generation means comprises a pump and
26 a vacuum device and is adapted to be selectively
27 switched between the pumping and vacuum producing
28 modes as desired.

29
30 Preferably, the intermediate or transfer pumping
31 and/or vacuum generation means also comprises an

1 intermediate storage tank and is typically located
2 upstream of the container.

3

4 Preferably, the material urging means comprises a
5 second tubular conduit which passes through an
6 outlet portion of the container and more preferably
7 further comprises vacuum generation means connected
8 thereto.

9

10 Preferably, the inlet and outlet portions are spaced
11 apart across a diameter of the first container in
12 order to prevent material exiting the inlet portion
13 from entering the outlet portion. Optionally, a
14 filter may also be provided on the outlet portion to
15 further prevent the material from entering the
16 outlet portion and hence the vacuum generation
17 means. Typically, the inlet and outlet portions are
18 located toward the upper end of the first container.

19

20 Typically, the fluid is gaseous and preferably is
21 air.

22

23 Typically, the material is a highly viscous material
24 which is typically drill cuttings or similar
25 hydrocarbon exploration and production industry by-
26 products.

27

28 Embodiments of the invention have the advantage that
29 they allow material to be pumped by the intermediate
30 or transfer pumping and/or vacuum generation means
31 along the first conduit until it is expelled into
32 the container from the inlet portion on the first

1 conduit. The progression of the material along the
2 first conduit and into the container is eased and/or
3 assisted by the simultaneous substantial vacuum
4 provided across the diameter of the container as
5 provided by the second conduit and the vacuum
6 generation means.

7
8 Preferably, the apparatus further comprises a second
9 container which contains material which has
10 preferably been pressurised and which is typically
11 located upstream from the first container and which
12 is further preferably located upstream from the
13 intermediate or transfer pumping and/or vacuum
14 generation means. Typically, the second container
15 is connected to the first container such that
16 material may be transferred therebetween. More
17 preferably, the connection between the first and
18 second containers passes through at least a portion
19 of the intermediate or transfer pumping and/or
20 vacuum generation means.

21
22 This allows a small amount (limited by the maximum
23 volume of the intermediate or transfer pumping
24 and/or vacuum generation means) of material to be
25 sucked by the vacuum of the intermediate or transfer
26 pumping and/or vacuum generation means from the
27 second container and into an intermediate storage
28 tank of the intermediate or transfer pumping and/or
29 vacuum generation means. The pressurised contents
30 of the second container typically assist in this
31 regard by providing a positive pressure differential
32 from the inside of the second container to the

1 outside. When the intermediate storage tank is full
2 the intermediate or transfer pumping and/or vacuum
3 generation means is then switched either manually or
4 automatically to its pumping mode in order to pump
5 the contents of the intermediate storage tank into
6 the first container (which is assisted by the vacuum
7 produced in the first container by the second
8 conduit and vacuum generation means).

9

10 Typically, the first and/or second containers are
11 large, silo-type containers which are typically
12 cylindrical in shape. Preferably, the or each
13 container is provided with a plurality of
14 circumferentially arranged material chutes,
15 preferably having a multi-sided (which in preferred
16 embodiments is hexagonal) cross section, adapted to
17 substantially prevent the material within the or
18 each container from becoming compacted such that the
19 material will no longer flow. Preferably, a
20 separation device, which is preferably a cone having
21 a multisided (which in preferred embodiments is
22 hexagonal) cross section, is provided adjacent the
23 chutes in order to substantially prevent large lumps
24 of material from settling within the chutes.
25 Alternatively, a standard conically shaped silo
26 chute may be provided on the or each container.

27

28 An embodiment of the present invention will now be
29 described with reference to the accompanying
30 drawings, in which:-

31

1 Fig. 1 is a schematic diagram showing the flow
2 of drill cuttings through apparatus in
3 accordance with the present invention;
4 Fig. 2A is a schematic front view diagram of a
5 tank used in the apparatus of Fig. 1;
6 Fig. 2B is a plan view of the top of the tank of
7 Fig. 2A looking in the direction indicated by
8 the reference lines B-B;
9 Fig. 2C is a partial cross-sectional side
10 elevation of the tank of Fig. 2A;
11 Fig. 2D is a cross-sectional view of the valve
12 arrangement on the bottom of the tank of Fig. 2A
13 taken through the line C-C;
14 Fig. 2E is a partial cross-sectional view of the
15 tank of Fig. 2C looking in the direction
16 indicated by reference line D; and
17 Fig. 2F is a cross-sectional view of the tank of
18 Fig. 2E taken through the line E-E showing the
19 hexagonal chute and cone arrangement used in
20 conjunction with a preferred embodiment of the
21 apparatus.
22
23 Referring to Fig. 1, drill cutting material
24 transportation apparatus 10 is provided. The
25 apparatus 10 has a first vacuum/pump unit 12
26 connected to a holding tank 14 by a holding tank
27 input pipe 16. The holding tank 14 is connected to
28 a second vacuum/pump unit 18 by a holding tank
29 output pipe 20. The second vacuum/pump unit 18 also
30 connects to a transportation tank 22 via a transfer
31 pipe 24. A vacuum pipe 26 connects to a third

1 vacuum/pump unit 28 and is in fluid communication
2 with the inside of the transportation tank 22.

3
4 The vacuum/pump units 12, 18, 28 can be selectively
5 switched between a vacuum mode which sucks material
6 into an integrated transfer tank 30 and a pumping
7 mode which blows material out of the integrated
8 transfer tank 30 under pressure. The pressure
9 differential required for both the vacuum and
10 pumping modes is provided by an air compressor (not
11 shown) attached to or integrated with the units 12,
12 18, 28. An example of a preferred unit 12, 18, 28
13 able to provide such pumping and vacuum capabilities
14 is the SUPAVAC[™] system distributed worldwide for the
15 oil and gas industry by ITS Drilling Services
16 Limited of Aberdeen, UK, but the skilled reader will
17 realise that other conventional vacuum/pump units
18 may also be suitable although such other
19 conventional vacuum/pump units may not operate as
20 quickly nor as efficiently.

21
22 The holding tank 14 and transportation tank 22 are
23 large cylindrical tanks 14, 22 which are able to
24 hold a relatively large volume of material.
25 Typically, the holding tank 14 and transportation
26 tank 22 are each able to hold around 15m³ to 20m³ of
27 material, though it should be noted that smaller or
28 larger tanks could be used without affecting the
29 overall operation of the apparatus 10.

30
31 The holding tank 14 is provided with an external
32 upright pipe 32 which extends from the bottom of the

1 tank 14 to the roof of the tank 14 at which point it
2 terminates with an aperture 34, such that the
3 interior of the external upright pipe 32 is in fluid
4 communication with the interior of the holding tank
5 14. The bottom of the external upright pipe 32 is
6 connected to the first vacuum unit 12 by the holding
7 tank input pipe 16. Though the upright pipe 32 is
8 provided externally in the apparatus 10 shown in the
9 Figures, it should be appreciated that this upright
10 pipe may alternatively be provided internally.

11

12 The bottom of the holding tank 14 may simply have a
13 standard flat or conically shaped exit chute
14 connected to outlet valves; however in the present
15 and preferred embodiment (as best seen in Figs. 2C,
16 2E and 2F) a number of hexagonal chutes 36 are
17 provided around the circumference of the tank 14
18 bottom in a honeycomb arrangement. A cone 40 having
19 a hexagonal cross section is also provided in the
20 centre of the circumferentially arranged hexagonal
21 chutes 36, the purpose of which will be described
22 subsequently. A suitable honeycomb shaped insert 36
23 is described in PCT Application No WO 00/55073, the
24 contents of which are incorporated herein by
25 reference.

26

27 The lowermost point of each chute 36 is provided
28 with an outlet discharge valve 38 connected to
29 discharge tubes 42 which converge onto the end of
30 the holding tank output pipe 20.

31

1 A substantial number of components on the
2 transportation tank 22 are substantially the same as
3 the holding tank 14 and will therefore not be
4 described further. In the following description,
5 where this applies the same reference numeral has
6 been used with an additional A being suffixed to the
7 reference numeral.

8
9 Unlike the holding tank 14, the discharge tubes 42A
10 of the transportation tank 22 are not connected to
11 an output pipe in the arrangement shown in Fig. 1.
12 In addition however, a further external upright pipe
13 44 is provided for the tank 22 opposite the external
14 inlet upright pipe 32A. A vacuum pipe inlet
15 aperture 46 is provided on the upper end of the
16 additional external upright pipe 44, the purpose of
17 which will be described subsequently. The
18 additional external upright pipe 44 extends
19 downwardly from the vacuum pipe inlet aperture 46
20 and connects to the vacuum pipe 26 which leads on to
21 the third vacuum unit 28.

22
23 It should be noted that the length of the pipes 16,
24 20, 24, 26 in Fig. 1 are not to scale and have been
25 altered for clarity. Indeed the transfer pipe 24
26 must be long enough to allow material to be
27 transported from the vacuum unit 18 adjacent the
28 holding tank 14 located on the rig (not shown) to
29 the transportation tank located on the supply vessel
30 (not shown) and this distance is likely to vary in
31 length per application or project, typically from
32 10m to 200m in length.

1
2 In the following description the flow of drill
3 cuttings throughout the apparatus 10 is illustrated
4 by dark shaded arrows 48 on Fig. 1 and the negative
5 suction (or vacuum) pressure differential created by
6 the vacuum units 12, 18, 28 is illustrated by the
7 unshaded arrows 50.

8
9 In operation, the vacuum mode of the first vacuum
10 unit 12 is switched on. This creates a vacuum in
11 the tank 30 which sucks drill cuttings 48 into the
12 tank 30. It should be noted that the drill cuttings
13 48 are initially output from a primary drill cutting
14 treatment equipment such as shale shaker/centrifuge
15 etc. such as those typically used in drilling
16 operations. The vacuum in the transfer tank 30 is
17 sustained until the transfer tank 30 is filled with
18 drill cuttings 48 which typically occurs when around
19 400 litres are contained within the tank 30. When
20 full, the transfer tank 30 can no longer suck drill
21 cuttings 48 and must now be emptied.

22
23 In order to empty the tank 30, the first vacuum unit
24 12 is switched to its pumping mode. In its pumping
25 mode, compressed air is introduced into the tank 30
26 by the compressor (not shown). The increased
27 pressure within the tank 30 expels the drill
28 cuttings 48 within the tank 30 into the holding tank
29 input pipe 16. The drill cuttings 48 are progressed
30 up the upright pipe 32 due to pressure of compressed
31 air in the tank 30 acting upon them until they reach
32 the internal inlet aperture 34, at which point the

1 drill cuttings 48 enter the holding tank 14.
2 Gravity causes the drill cuttings 48 to fall toward
3 the bottom of the tank 14 and in so doing begins to
4 fill the holding tank 14 from the bottom upwards.

5
6 Once the first vacuum unit 12 has expelled the
7 contents of its tank 30 into the holding tank 14, it
8 is then switched back to vacuum mode (either
9 automatically or by a manual operator) in order to
10 refill with drill cuttings 48 from the shale shaker/
11 centrifuge, etc. on the rig platform (not shown).
12 Once filled with the next load of drill cuttings 48
13 the first vacuum unit 12 empties its contents into
14 the tank 14 in a similar fashion as previously
15 described. This cyclical filling and emptying of
16 the tank 30 is repeated by the first vacuum unit 12
17 until the holding tank 14 is filled to a desired
18 level determined by the user. The weight, and hence
19 volume, of material within the holding tank 14 can
20 be calculated by the user by subtracting the known
21 empty weight of the holding tank 14 from the total
22 weight of the holding tank 14 in operation whilst
23 taking into account the effect of the specific
24 gravity of the material (when calculating the
25 volume).

26
27 It should be noted that the vacuum units 12, 18, 28
28 have very few moving parts e.g. impellers etc. since
29 these could be easily clogged up by the highly
30 viscous material passing through the units.
31 Instead, the vacuum units 12, 18, 28 mainly comprise
32 chambers and valves (not shown) which, in

1 conjunction with the compressed air supply can be
2 manipulated to provide the necessary vacuum or
3 pumping action as required.

4
5 Though a single holding tank 14 is shown in Fig. 1,
6 in order to increase the capacity of the rig for
7 retaining drill cuttings 48 before they must be
8 offloaded, the rig may have a number of holding
9 tanks 14. A typical number of holding tanks on the
10 rig would be between 1 and 8 though more could be
11 provided if the rig structure permits. When a
12 number of holding tanks 14 are provided, the input
13 pipe 16 is simply detached when the holding tank 14
14 to which it is connected is full, and is then
15 reconnected to an empty holding tank 14.

16
17 When it is desired to transfer the contents of the
18 holding tank 14 to, for example, a sea going supply
19 vessel (not shown), one end of the holding tank
20 output pipe 20 is connected to the discharge tubes
21 42 of the holding tank 14 to be emptied. The other
22 end of the holding tank output pipe 20 is connected
23 to the inlet of the second vacuum unit 18. The
24 remaining space within the top of the holding tank
25 14 is then pressurised (while the discharge valves
26 38 are closed) either using an additional pressure
27 source such as a pneumatic pump or the air
28 compressor or using the first vacuum unit 12 in its
29 pump mode. This pressurised zone results in the
30 contents of the holding tank 14 being urged towards
31 the bottom of the tank 14. The discharge valves 38
32 on the bottom of the holding tank 14 are then opened

1 and the tank 30 on the second vacuum unit 18 is then
2 filled by creating a vacuum in the tank 30 in a
3 similar way to that previously described for the
4 first vacuum unit 30. The vacuum 50 created along
5 the output pipe 20 by the second vacuum unit 18
6 (combined with the pressure exerted on the drill
7 cuttings 48 within the holding tank 14 by the
8 pressurised zone) draws the drill cuttings 48 from
9 the holding tank 14. When the tank 30 on the second
10 vacuum unit 18 is filled with drill cuttings 48, the
11 vacuum unit is switched off in preparation for
12 pumping the drill cuttings 48 into the
13 transportation tank 22 located on, for example, the
14 supply vessel. A number of these transportation
15 tanks 22 may be provided on the supply vessel e.g.
16 from 1 to 20 tanks in order to maximise the drill
17 cutting transport capacity of the supply vessel.

18
19 When the unit 18 is switched to pumping mode it
20 begins to pump the drill cuttings 48 along the
21 transfer pipe 24 by introducing compressed air into
22 the tank 30. While the drill cuttings 48 are being
23 pumped along the transfer pipe 24, the third vacuum
24 unit 28 simultaneously operates in its vacuum mode
25 in order to create a vacuum along the vacuum pipe
26 26. The vacuum present in the vacuum pipe 26 is
27 communicated to the inside of the transportation
28 tank 22 due to the open end of the vacuum pipe 26
29 provided by the vacuum pipe inlet aperture 46. The
30 effect of the pumping action provided by the second
31 vacuum unit 18 combined with the vacuum created in
32 the transportation tank 22 provides a large pressure

1 differential across the drill cuttings 48 travelling
2 along the length of the transfer pipe 24. The
3 magnitude of this pressure differential is
4 substantially greater than that obtainable by only
5 performing one of the pumping or sucking operations
6 and is ideally suited to ensuring that the viscous
7 material e.g. drill cuttings (which have a tendency
8 to stick together and block pipes components)
9 continue to flow through the apparatus 10. This is
10 even true over the relatively long distance required
11 to transfer the drill cuttings 48 (through the
12 transfer pipe 24) from the rig platform to the
13 supply vessel.

14
15 When the drill cuttings 48 reach the internal inlet
16 aperture 34A they escape into the transportation
17 tank 22 and fall under the action of gravity toward
18 the bottom of the tank 22. It should be noted that
19 the pressure differential across the transportation
20 tank inlet aperture 34A and the vacuum pipe inlet
21 aperture 46 is not great enough to suck the drill
22 cuttings across the gap between these apertures. In
23 this regard, when the drill cuttings 48 within the
24 transportation tank 22 reach a certain level the
25 transfer operation should be switched to another
26 transportation tank (not shown) since if the
27 transportation tank 22 is over filled, drill
28 cuttings 48 would be more likely to enter the vacuum
29 pipe 26, which is undesirable. When each
30 transportation tank 22 on the vessel has been filled
31 to the desired level, the transportation tank input

1 pipe 24 is disconnected and the vessel may proceed
2 to the onshore based processing/disposal facility.

3

4 The cone 40, 40A in the holding tank 14 and
5 transportation tank 22 respectively serve to divide
6 the drill cuttings 48 falling from the inlets 34,
7 34A between the chutes 36, 36A. The relatively
8 small cross section of the plurality of chutes 36,
9 36A (when compared to the situation if only a single
10 chute were located on the bottom of the tanks 14,
11 22) provide a number of smaller individual areas
12 upon which the material above can press upon which
13 makes hard packing of the drill cuttings located at
14 the bottom of the tanks 14, 22 less likely.

15

16 When the transportation tanks 22 are to be emptied
17 the remaining space within the top of the
18 transportation tank 22 can be pressurised (while the
19 discharge valves 38A are closed) either using an
20 additional pressure source such as a pneumatic pump
21 (not shown) or using the third vacuum unit 28 in the
22 pump mode (and/or if it is available, the second
23 unit 18, as will be described subsequently). This
24 pressurised zone results in the contents of the
25 transportation tank 22 being urged towards the
26 bottom of the tank 22 in a similar fashion to that
27 previously described for the holding tank 14. The
28 discharge valves 38A on the bottom of the
29 transportation tank 22 are then opened and the
30 contents either removed simply due to the
31 pressurisation in the transportation tank 22 or by
32 attaching it to a further vacuum unit (not shown).

1
2 Modifications and improvements may be made to the
3 embodiments hereinbefore described without departing
4 from the scope of the invention.

5
6 For instance, although the embodiment of the
7 apparatus 10 described above is used to transfer
8 drill cuttings, the apparatus 10 may be used to
9 transfer any material which will flow through a
10 pipe, and is particularly useful for transporting
11 materials which would otherwise tend to become stuck
12 in pipes.

13
14 The vacuum units 12, 18 may be substituted with any
15 vacuum unit, particularly those capable of both
16 acting as a vacuum and as a pump without becoming
17 clogged with the material passing through it. The
18 vacuum unit 28 may be substituted by a unit capable
19 of creating a powerful enough vacuum.

20
21 Furthermore, the second vacuum/pumping unit 18 could
22 instead be situated on the supply vessel rather than
23 on the drilling rig; in this case, the transfer pipe
24 would be regarded as pipe 20 (suitably lengthened)
25 and the pipe 24 would be suitably shortened.

1 CLAIMS:-

2

3 1. A method of transferring material from a first
4 location to a second location comprising the steps
5 of:-

6 providing a container containing fluid;
7 transferring material from a first location
8 outside of the container to a second location inside
9 the container; and

10 at least partially evacuating fluid from within
11 the container in order to facilitate progression of
12 the material into the container.

13

14 2. A method according to claim 1, wherein the
15 transfer of material from the first location to the
16 second location and evacuating the fluid from the
17 container are performed substantially
18 simultaneously.

19

20 3. A method according to either of claims 1 or 2,
21 wherein the method further comprises the step of
22 transferring the material along a first conduit
23 under application of pressure upstream of the
24 material, in order to progress the material from a
25 first location outside of the container to a second
26 location inside the container.

27

28 4. A method according to claim 3, wherein the
29 method further comprises the step of at least
30 partially evacuating air from the container along a
31 second conduit in order to substantially create a
32 vacuum within the container.

1

2 5. A method according to any preceding claim,
3 wherein the fluid is at least partially evacuated
4 from the container whilst substantially avoiding
5 removal of the material from the container.

6

7 6. A method according to any preceding claim,
8 wherein the method further comprises the step of
9 providing a second container upstream of the first
10 container.

11

12 7. A method according to claim 6, wherein the
13 second upstream container provides a temporary
14 storage facility for material to be transported.

15

16 8. A method according to either of claims 6 or 7,
17 wherein the method further comprises the step of
18 providing a first pumping means for pumping material
19 into the second container under pressure such that
20 the material is deposited in the second container
21 prior to being transferred to the first container.

22

23 9. A method according to claim 8, wherein pressure
24 is applied to the second container and the material
25 therein when the second container contains a desired
26 level of material.

27

28 10. A method according to claim 9, wherein the
29 second container is then emptied by evacuating at
30 least a portion of the material within the second
31 container, along a discharge conduit.

32

1 11. A method according to claim 10, wherein the
2 action of evacuating at least a portion of the
3 material along the discharge conduit is assisted by
4 the pressure applied to the second container.
5

6 12. A method according to either of claims 10 or
7 11, wherein discharge conduit is in fluid
8 communication with the first conduit via an
9 intermediate vacuum generation means in order to
10 allow the material from the second container to be
11 conveyed to the first container.
12

13 13. A method according to any preceding claim,
14 wherein the first container is located on a
15 transportation means and the second container is
16 located proximal to the first pumping means and also
17 is located proximal to a supply of the material in
18 the form of a primary drill cuttings source on a
19 drilling rig.
20

21 14. A method according to any preceding claim,
22 wherein the intermediate transfer vacuum generation
23 means is located proximal to and downstream of the
24 second container.
25

26 15. A method according to any preceding claim,
27 wherein a transfer conduit connects the intermediate
28 vacuum generation means to the first container.
29

30 16. A method according to any preceding claim,
31 wherein the material comprises drill cuttings.
32

- 1 17. Material transfer apparatus comprising:-
2 a container containing fluid;
3 material transfer means adapted to transfer
4 material from a first location outside the container
5 to a second location inside the container; and
6 material urging means adapted to facilitate
7 transfer of the material from the first location to
8 the second location by at least partially evacuating
9 fluid from within the container.
10
- 11 18. Material transfer apparatus according to claim
12 17, further comprising a first tubular conduit which
13 passes through an inlet portion of the container and
14 an intermediate vacuum generation means connected
15 thereto.
16
- 17 19. Material transfer apparatus according to claim
18 18, wherein the intermediate vacuum generation means
19 comprises a pump and a vacuum device and is adapted
20 to be selectively switched between the pumping and
21 vacuum producing modes as desired.
22
- 23 20. Material transfer apparatus according to claim
24 19, wherein the intermediate vacuum generation means
25 also comprises an intermediate storage tank and is
26 located upstream of the container.
27
- 28 21. Material transfer apparatus according to claim
29 20, the material urging means comprises a second
30 tubular conduit which passes through an outlet
31 portion of the container.

1 22. Material transfer apparatus according to claim
2 21, wherein the material urging means further
3 comprises vacuum generation means connected thereto.
4

5 23. Material transfer apparatus according to either
6 of claims 20 or 21, wherein the inlet and outlet
7 portions are spaced apart across a diameter of the
8 first container in order to prevent material exiting
9 the inlet portion from entering the outlet portion.
10

11 24. Material transfer apparatus according to claim
12 23, wherein a filter is provided on the outlet
13 portion to further prevent the material from
14 entering the outlet portion and hence the vacuum
15 generation means.
16

17 25. Material transfer apparatus according to either
18 of claims 23 or 24, wherein the inlet and outlet
19 portions are located toward the upper end of the
20 first container.
21

22 26. Material transfer apparatus according to any of
23 claims 17 to 25, wherein the fluid is air.
24

25 27. Material transfer apparatus according to any of
26 claims 17 to 26, wherein the material is hydrocarbon
27 exploration and production industry by-products in
28 the form of drill cuttings.
29

30 28. Material transfer apparatus according to any of
31 claims 17 to 27, wherein the apparatus further
32 comprises a second container which contains

1 pressurised material and is located upstream from
2 the first container and is further located upstream
3 from the intermediate vacuum generation means.
4

5 29. Material transfer apparatus according to claim
6 28, wherein the second container is connected to the
7 first container such that material may be
8 transferred therebetween.
9

10 30. Material transfer apparatus according to claim
11 29, wherein the connection between the first and
12 second containers passes through at least a portion
13 of the intermediate vacuum generation means.
14

15 31. Material transfer apparatus according to any of
16 claims 28 to 30, wherein the first and second
17 containers are substantially cylindrical silo
18 containers.
19

20 32. Material transfer apparatus according to any of
21 claims 28 to 31, wherein the or each container is
22 provided with a plurality of circumferentially
23 arranged material chutes, having a multi-sided cross
24 section, adapted to substantially prevent the
25 material within the or each container from becoming
26 compacted such that the material will no longer
27 flow.
28

29 33. Material transfer apparatus according to claim
30 31, wherein a separation device is provided adjacent
31 the chutes in order to substantially prevent large
32 lumps of material from settling within the chutes.

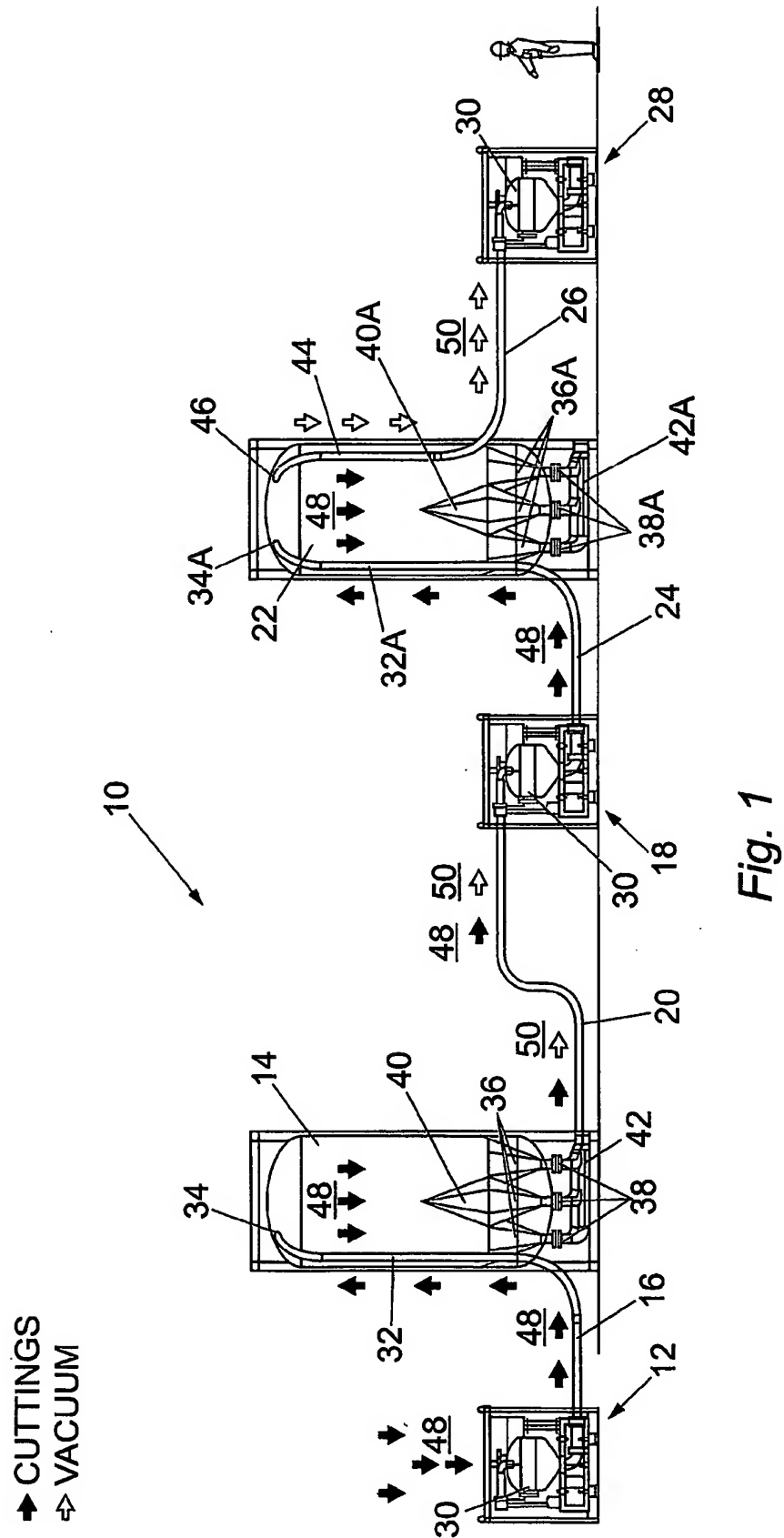


Fig. 1

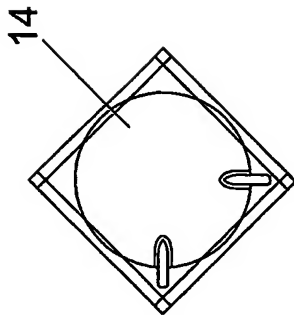


Fig. 2B

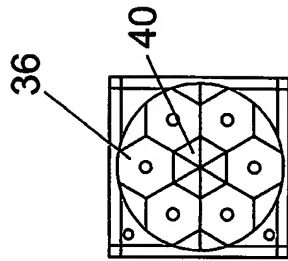


Fig. 2F

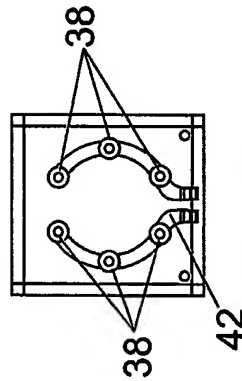


Fig. 2D

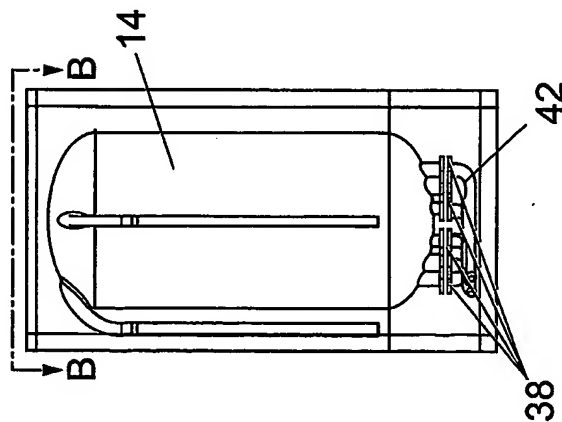


Fig. 2A

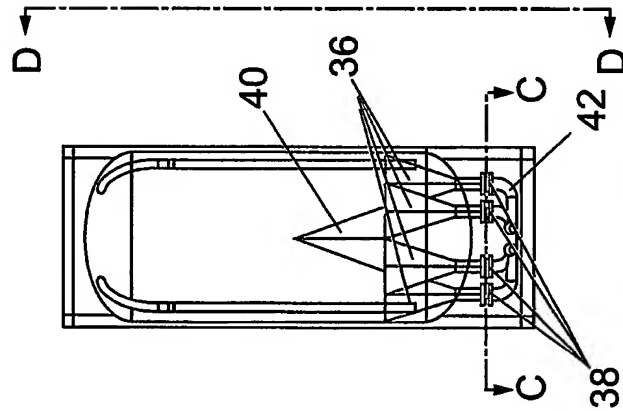


Fig. 2C

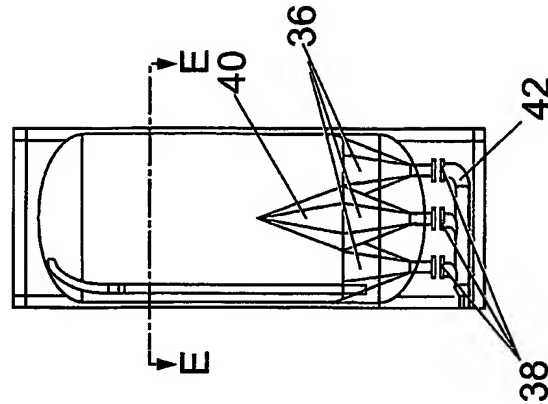


Fig. 2E

INTERNATIONAL SEARCH REPORT

Inter Application No
PCT/GB2005/001606

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	page 2, line 55 - page 3, line 1; abstract; figure 1	3,4, 6-13, 19-25, 28-33
X	----- GB 2 087 335 A (DUNDEE CEMENT CO; CYCLONAIRE CORP) 26 May 1982 (1982-05-26)	1,2,5, 14-18, 26,27
A	page 1, lines 5-14; page 2, line 87 - page 3, line 29; page 3, line 94 - page 4, line 17; page 4, lines 58-66; abstract; figure 2	3,4, 6-13, 19-25, 28-33
Y	----- WO 00/55073 A (CURLE, WILLIAM) 21 September 2000 (2000-09-21)	32,33
A	page 28, line 7 - page 29, line 7; figures 7-14	1-31
A	----- US 2002/187012 A1 (GRASSHOFF HERBERT) 12 December 2002 (2002-12-12) abstract; figures	1-33

INTERNATIONAL SEARCH REPORT

International Application No
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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B65G53/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65G E21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 695 205 A (LEVINE ET AL) 22 September 1987 (1987-09-22)	1-7, 14-18, 26-31
Y	column 2, line 55 - column 3, line 65; column 4, line 10 - column 5, line 45;	32,33
A	claims; figure	8-13, 19-25
X	DE 24 37 799 A1 (SPITZER SILOFAHRZEUGE KG, 6950 MOSBACH; SPITZER SILO- FAHRZEUGWERK KG,) 19 February 1976 (1976-02-19)	1,2,5, 15-19, 26,27
A	page 7, line 19 - page 9, line 16; page 10, line 6 - page 11, line 7; page 12, lines 13-23; figure 1	3,4, 6-14, 20-25, 28-33
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Date of the actual completion of the international search

21 July 2005

Date of mailing of the international search report

03/08/2005

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